

REMARKS

Reconsideration of this application and the rejection of claims 21-32 are respectfully requested. Applicant has attempted to address every objection and ground for rejection in the Office Action dated June 27, 2008 (Paper No. 20080623) and believes the application is now in condition for allowance. The claims have been amended to more clearly describe the present invention.

Claims 22, 23 and 27 are objected to as being dependant upon a rejected base claim but would be allowable if rewritten in independent form.

Applicant has added new claims 33-35. New claim 33 includes the subject matter of claim 21 and allowed claim 22. Claim 22 has been cancelled. New claims 34 and 35 depend from new claim 33 and respectively include the subject matter of allowed claims 23 and 27. Claims 23 and 27 have been cancelled. Applicant submits that new claims 33-35 are in condition for allowance.

Of the remaining claims, claims 21, 24 and 25 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,722,343 to Aurik et al.

Aurik discloses a method of controlling a milking processing system including a milking rack 3 which is automatically placed in position relative to a cow K by a robot arm (Col. 2, lines 41-54). Extracted milk is transferred to a buffer tank 6 and then to a filtering apparatus 13, which separates residue from the milk. The residue is clotted milk or contaminated milk that is separated out and then tested to determine the quantity and nature of the contamination (Col. 5, lines 13-22).

In contrast, amended claim 21 recites, among other things, an apparatus for on-farm separation of at least one milk component from milk that includes "a first holding vessel connected to the stall for receiving successive measures of milk from successive dairy animals" and "at least one first separation device connected to said first holding vessel for receiving the successive measures of milk and separating each measure of milk into at least one refined milk component according to at least one physicochemical property of the component and a residual milk measure." Aurik fails to disclose such subject matter.

Aurik does not disclose the separation of a milk measure into a refined milk component and a residual milk measure. As stated above, Aurik discloses collecting contaminants and residues (i.e., coagulated masses of varying compositions), such as clotted milk, in a filter. The residue or contaminants are therefore separated from the milk based only on the physical size of the contaminants and not based on the physicochemical properties of the contaminants or any other properties. In contrast, claim 21 recites, among other things, separating at least one refined milk component based on the physicochemical property of the component. According to the specification, such components include "milk by-products including carbohydrates, whey protein bioactives such as lactoferrin" (specification, page 1, lines 13-15), "endogenous milk proteins, fats, enzymes, cells, ions and nucleic acids" (specification, page 4, lines 3-5) and "somatic cells, antibiotics, hormones...beta-lactoglobulin and lactose" (specification, page 8, lines 8-12). Aurik does not disclose separating out refined milk components such as those listed above.

Further, Aurik does not remove the residue contaminants for the purpose of removing harmful substances from the milk, but instead collects the milk clots such as mastitis, for analysis (Col. 5, lines 8-22). Most of the contaminants in the mastitic milk, such as somatic cells and antibiotics, will not be entirely formed into the separated milk clots and therefore will not be captured by the filter. Aurik therefore does not disclose a separation device that separates a refined milk component according to at least one physicochemical property as recited in claim 21 as most of these components would still remain in the milk after filtration.

For at least these reasons, Applicant submits that amended claim 21, and the claims that depend therefrom, are each patentably distinguished over Aurik and in condition for allowance.

Claims 26 and 29 are rejected under 35 U.S.C. §102(b) as being anticipated by Aurik. Amended claim 26 recites, among other things, a method for on-farm separation of at least one milk component from milk produced by a plurality of dairy animals including the steps of "extracting a measure of milk from one of said dairy animals in a stall of a robotic milking device adapted to allow one dairy animal to freely enter at any time;" "passing said measure of milk to a holding vessel feeding at least one separation device;" "operating said at least one separation device to separate said measure of milk into said at least one refined milk component according to at least one physicochemical property of the component and a residual milk measure;" and repeating the above steps in turn for each of the plurality of dairy animals. Aurik fails to disclose such subject matter.

As stated above, Aurik discloses a milking processing system that removes and contaminants such as milk clots (i.e., mastitis) for the purpose of analysis. Much of the contaminants in mastitic milk "such as somatic cells and antibiotics," are not included in the removed clots and therefore are not captured by the filter in Aurik.

Specifically, Aurik states that:

The result of such a decision may be that in future milking sessions the milk is separated and that the cow is for instance also separated and/or that the operator is alerted. On the basis of repeated detection it can be concluded whether the contamination is specific to one animal or whether it occurs in the whole herd (Col. 5, lines 17-23).

Aurik does not state or suggest that the contaminants or residue, such as the somatic cells or antibiotics, are separated from the milk at the time of milking, thereby purifying the residual measure of milk. Instead, Aurik discloses that contaminated milk could be separated from the collected milk in subsequent milking sessions.

In contrast, amended claim 26 allows for the removal or separation of at least one refined milk component according to at least one physicochemical property of the component at the time of milking. This allows the milk to be collected by a farmer without the penalties or problems associated with contaminated milk. This increases the volume of milk that is produced for sale compared with systems that produce less sellable milk, such as Aurik, because such systems require the separation and dumping of the contaminated milk. Therefore, the separation of specific, targeted contaminants from the milk by the method

recited in amended claim 26 is a significant advantage over existing milking systems such as Aurik that do not separate out targeted contaminants as in Aurik.

Furthermore, a person of ordinary skill in the art would not consider it obvious to separate or filter out targeted contaminants or components of milk according to their physicochemical properties where Aurik does not disclose or suggest such a filtration system.

Additionally, the method recited by amended claim 26 also collects refined components that are not considered contaminants at all, but rather are valuable components of the milk, such as whey protein bioactives or lactoferrin that are used for manufacturing pharmaceutical products. Also as stated above, the method of amended claim 26 facilitates the collection of targeted milk components on the farm during the milking process, which helps to reduce the transportation costs otherwise incurred in separating the components from the milk at a separate specialized treatment station after having been previously transported to a dairy product processing plant.

For all these reasons, Applicant submits that claims 26 and 29 are each patentably distinguished over Aurik and in condition for allowance.

Claims 28 and 30-32 are rejected under 35 U.S.C. §103(a) as being unpatentable over Aurik. Claims 28 and 30-32 depend from amended claim 26. Applicant therefore submits that claims 28 and 30-32 are patentably distinguished over Aurik for at least the reasons provided above with respect to amended claim 26, and for the further reason that Aurik does not disclose the subject matter of claims 28 and 30-32 in combination with the subject matter of amended claim 26.

Claims 26 and 28-32 are objected to based on informalities. Specifically, claim 26 is objected to because the Examiner states that the phrase "each said" at line 8 should be changed to "said at least one." Applicant has amended claim 26 according to the Examiner's suggested amendment. Applicant therefore requests that the objection to claims 26 and 28-32 be withdrawn.

The Examiner states that a copy of International Patent Document No. WO 02/074070 A1 seems to be absent from the Supplemental Information Disclosure Statement previously filed on May 7, 2007. Accordingly, Applicant has included a copy of International Patent Document No. WO 02/074070 A1 and respectfully requests consideration of same.

Applicant submits that in view of the above-identified amendments and remarks, the claims in their present form are patentably distinct over the art of record. Allowance of the rejected claims is respectfully requested. Should the Examiner discover there are remaining issues which may be resolved by a telephone interview, the Examiner is invited to contact Applicant's undersigned attorney at the telephone number listed below.

Respectfully submitted,

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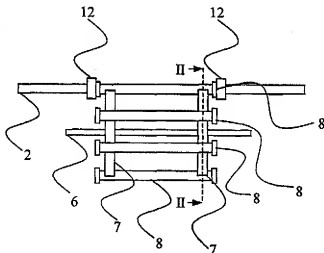
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(54) Title: A METHOD AND AN ARRANGEMENT FOR FILTERING MILK



(57) Abstract: The present invention provides an arrangement for filtering milk in a milking system, wherein said arrangement comprises a movable filter magazine provided with at least three filter devices (8), each of which comprises a tube housing a disposable filter and a support structure for supporting the disposable filter, and each of which is connectable to said milking system for filtering milk therein; and an actuating device for connecting each of said at least three filter devices, one at a time, to said milking system.

WO 02/074070 A1

A METHOD AND AN ARRANGEMENT FOR FILTERING MILK**FIELD OF INVENTION**

The present invention relates generally to dairy farming and particularly to an arrangement and a method, respectively,
5 for filtering milk in a milking system.

BACKGROUND

There are many duties to carry out on a dairy farm and some of these have to be carried out on specific times. For instance, when milk has been collected from a milk storage
10 tank by a milk lorry, e.g. every second day, the milk storage tank has to be cleaned. Suitably, the rest of the milking system is then cleaned along with the milk storage tank.

Due to hygienic requirements the milking system comprises a
15 milk filter, which milk filter further has to be cleaned or replaced by a new milk filter regularly, generally, three times per day and night. Suitably, the milk filter is renewed or replaced when the milking system has been cleaned. As the milk filter is renewed or replaced
20 regularly, some of the renewals or replacements will need to be carried out at odd working hours, e.g. during the night.

It is therefore desirable to perform the renewal or replacement of the filter at least partially automatically, such that the operator of the milking system need not attend
25 the milking system during these odd working hours.

In EP 0653153 A1 a milking machine is disclosed provided with one or more filtration devices, each being provided with a filter, for filtering milk. When the milking machine is cleaning a cleaning liquid is led through a filter in a

direction opposite to that in which the milk passes during filtration. A disadvantage of such a filtration device is that the back flush cleaning involves risks of catching dirt in the filter, which thereafter may come loose during milking and contaminate the milk.

Further, EP 0653153 A1 describes that several filter devices, connected by a piping, may be used, wherein one filter device may be renewed while another one is used for filtering milk. A disadvantage of such an arrangement is that the piping connecting the filters necessarily include corners, branches and recesses, may be difficult to clean. Further, such filter devices have to be renewable, and thus disposable filters are not suitable to be used.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an arrangement and a method, respectively, for filtering milk in a milking system, which allow an operator of the milking system to change disposable filters in a milking system only once per day and night, suitably at a time convenient to the operator.

This object, among others, is according to the present invention attained by arrangements and methods, respectively, as defined in the appended claims.

Further features and advantages of the present invention will be evident from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description of preferred embodiments given below and the accompanying Figs. 1-6, which are given by way

of illustration only, and thus, are not limitative of the present invention, wherein:

Fig. 1 shows schematically a milking system including a filter arrangement according to the present invention;

- 5 Fig. 2 illustrates a filter arrangement including a revolver filter magazine according to a first embodiment of the present invention;

Fig. 3 illustrates a cut along the line II-II of Fig. 2;

- Fig. 4 shows a support structure for a filter sock of a
10 filter device suitable to be used with the present invention;

Fig. 5 illustrates a filter arrangement including a linear filter magazine according to a second embodiment of the present invention; and

- 15 Fig. 6 illustrates a cut along the line VI-VI of Fig. 5.

DETAILED DESCRIPTION OF EMBODIMENTS

- In the following description, for purpose of explanation and not limitation, specific details are set forth, such as particular techniques and applications in order to provide a
20 thorough understanding of the present invention. However, it will be apparent for a person skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details.

- A first embodiment of the present invention will now be
25 described with reference to Figs. 1-4.

An automatic milking system, as shown in Fig. 1, comprises a milking robot 1; a milk storage tank 3; a milk line 2 connecting the milking robot 1 with the milk storage tank 3;

a filter arrangement 4 for filtering milk in said milking system; and a controller 5 for controlling the milking system, e.g. controlling cleaning of the milking system.

The milking robot 1 is adapted for automatic milking of
5 animals, such as cows. Milk thus extracted by the milking robot 1 is transported in the milk line 2 to the milk storage tank 3 by means of a pump (not illustrated) or similar. The milk is suitably filtered in the filter arrangement 4 while being transported in the milk line 2.

10 The filter arrangement 4, illustrated more in detail in Figs. 2 and 3, comprises a movable filter magazine including a central shaft 6, and two circular support plates 7. The magazine can be loaded with up to six filter devices 8, each of which comprises a tube housing a disposable filter, such
15 as a filter sock, and a support structure for supporting the filter sock.

The support structure, illustrated in detail in Fig. 4, is adapted to support a filter sock (not shown), which suitably is thread over the support structure. The support structure
20 comprises a ring-shaped support 9 for engagement with the tube of the filter device 8 and a coarse cylindrical mesh 10 or similar attached to the ring-shaped support 9.

At the end of the coarse cylindrical mesh 10, which faces the incoming flow during filtration, is provided with a
25 plate 11. Firstly, such plate provides a good support for the filter sock, and secondly it forces the milk or cleaning fluid to flow over the whole mesh, thereby obtaining an excellent filter capability.

A tubular member (not shown) may be arranged around the
30 coarse mesh 10 at the other end thereof, i.e. adjacent to the ring-shaped support 9. Hereby, a dirt trap is formed by

the volume delimited by the ring-shaped support 9, the tubular member and the tube. Two small opposite holes is provided in the tubular member adjacent the ring-shaped support 9 such that a small flow out of the dirt trap is
5 obtained.

Thus, dirt, which is filtered out and transported by the flow of the milk or cleaning fluid along the filter sock, is collected in the dirt trap and does stop up the filter.

The six filter devices 8 are positioned symmetrically around
10 the shaft 6. The two plates 7 supports the six filter devices 8 in their respective ends. The shaft 6 is connected to the two plates 7, such that a revolving motion of the shaft 6 revolves the six filter devices 8.

Each of the six filter devices 8 is connectable in the milk
15 line 2 of the milking system, by moving the movable filter magazine.

An actuating device (not illustrated), such as an electric motor, is controlled by the controller to revolve the movable filter magazine stepwise.

20 A pneumatic or electric arrangement, also controllable by the controller 5, locks a filter device 8 in the milk line 2 by means of two pipe couplings 12 in a fluid-tight manner, such that a filter device 8 connected to the milk line, can be used to filter milk transported in the milk line 2
25 without any leakage.

When it is suitable to change filter in the milking system, e.g. due to the hygienic requirements, the filter device 8 connected to the milk line 2 is unlocked by the electric or pneumatic arrangement, and is removed from the milk line 2
30 by revolving the movable filter magazine as performed by the

actuating device, and another filter device 8 from the movable filter magazine is positioned in the milk line 2, and locked to the milk line 2 by the electric or pneumatic arrangement.

5 A sensor (not illustrated), such as an inductive sensor, may be used to detect the positions of the filter devices 8 in the movable filter magazine, e.g. to ensure that a filter device to be connected in the milk line 2 is in alignment therewith.

10 The sensor may be further used to detect the position of a particularly marked filter device. That position may be used to indicate when all the filter socks in the movable filter magazine have been used for filtering, e.g. by positioning the movable filter magazine after change of filter socks in
15 all filter devices 8 such that the particularly marked filter device is detected when the movable filter magazine has revolved a complete revolution.

The above-described embodiment, being provided with six filter devices 8, generally requires a change of disposable
20 filters only once every second day since the hygienic requirements prescribe change of filter socks three times per day and night. There is, however, a plurality of variations of the inventive filter arrangement, of which some are presented below.

25 If the milking system comprises a plate cooler (not illustrated) for pre-cooling of the milk, it is advisable to have a filter sock in the milking line both during milking and during cleaning of the milking system. It is usually adequate to use the same filter sock used during milking
30 also during cleaning. If, however, an improved cleaning is

desired, an unused filter sock may be utilized in the filter device during cleaning.

Furthermore, improved filtering may be achieved by changing filter socks more often than required.

- 5 If the milking system does not comprise a plate cooler, it is advisable to clean the milking system without any filter sock or support structure present in the filter device since a larger cleaning flow may then be obtained.

A movable filter magazine provided with three filter devices
10 is typically sufficient for change of the disposable filters only once per day and night in a milking system.

A movable filter magazine provided with three filter devices, each including a tube housing a filter sock and a support structure, and one filter device including an empty
15 tube (i.e. a dummy filter device) is sufficient for filtering milk three times and cleaning three times without a filter sock and a support structure present in the filter device. The controller 5 controls the connection/dis-connection of the filter devices 8 such that the filter
20 device including the empty tube is connected to the milking system while cleaning is performed, and the three filter devices 8 provided with a respective filter sock are alternately connected to the milking system such that milk is filtered through a clean filter sock when three cleanings
25 have been performed. Change of the disposable filters of the filter devices in the movable filter magazine is then necessary.

Alternative, a magazine may be provided with three filter devices 8, each including a tube housing a filter sock and a
30 support structure, and three dummy filter devices 8, each including an empty tube, positioned alternately such that

each filter device having a disposable filter neighbors two dummy filter devices. Hereby, the actuating device only needs to move the filter devices 8 a single step (i.e. a rotation of one sixth of a full revolution) to connect a filter device provided with a clean filter sock for filtering of milk subsequent to the cleaning of the milking system where a dummy filter device is connected in the milk line.

When it is time to change filter socks of the filter devices in the movable filter magazine, e.g. as indicated by a signal generated by the above-described sensor, or generated due to the period of time lapsed since the last change of filter socks having reached a threshold value, the operator removes the filter socks of the disconnected filter devices and provides the disconnected filter devices with clean filter socks. The movable filter magazine is then manually rotated one position, such that a filter device 8 including a clean filter sock is connected to the milk line 2. The filter sock of the last filter device is thereafter disposed of and replaced with a new clean one.

At the change of the filter socks, i.e. when the filter socks are removed, the tubes and support structures may be cleaned.

Two lids (not illustrated) may be positioned to cover the ends of the filter devices 8 not connected to the milk line 2, to prevent dirt from entering the tubes and the filter socks.

Alternatively, a protecting housing (not illustrated) may be provided for housing the whole filter arrangement 4, and thus dirt is prevented from entering the filter devices and contaminate the same.

A second embodiment of the present invention will now be described with reference to Figs. 5 and 6.

In this embodiment the movable filter magazine is a linear magazine, i.e. the filter devices 8 are arranged along a line therein and are supported by two support plates 13. An actuating device (not illustrated) is provided for linear movement of the movable filter magazine, such that the filter devices 8 in the movable filter magazine can be connected, one at a time, in the milk line 2 of the milking system of Fig. 1, by means of two pipe couplings 12.

In other respects this embodiment does not differ from the previous embodiment. Particularly, the discussion regarding the number of filter devices and the number of filter devices for cleaning purposes (i.e. filter devices including an empty tube) to be used is equally applicable as regards this second embodiment.

The second embodiment of the present invention may easily be fully automated by providing means (e.g. transport bands, robot arms, etc.) for removing used filter socks from the movable filter magazine and for arranging clean filter socks at empty positions of the movable filter magazine.

It will be obvious that the present invention may be varied in a plurality of ways. All such variations as would be obvious for a person skilled in the art are intended to be included within the scope of the present invention.

CLAIMS

1. An arrangement for filtering milk in a milking system, characterized in that said arrangement comprises

- a movable filter magazine provided with at least three
5 filter devices (8), each of which comprises a tube housing a disposable filter and a support structure for supporting the disposable filter, and each of which is connectable in said milking system for filtering milk therein; and

- an actuating device for connecting each of said at least
10 three filter devices, one at a time, in said milking system for filtering milk therein, by moving said movable filter magazine.

2. The arrangement as claimed in claim 1 wherein said movable filter magazine is a revolver magazine, which is
15 rotatably movable.

3. The arrangement as claimed in claim 1 wherein said movable filter magazine is elongated, said at least three filter devices are arranged along a line in said movable filter magazine and said movable filter magazine is linearly
20 movable.

4. The arrangement as claimed in any of claims 1-3 wherein said movable filter magazine is provided with a fourth filter device comprising an empty tube, and wherein said fourth filter device is connectable in said milking system
25 for cleaning of the milking system, and wherein said actuating device is adapted to connect said fourth filter device in said milking system while disconnecting one of said at least three filter devices by moving said movable filter magazine.

5. The arrangement as claimed in claim 4 wherein said movable filter magazine is provided with a fifth and a sixth filter device, each of which comprises an empty tube, and each of which is connectable in said milking system for
5 cleaning of the milking system, and wherein said actuating device is adapted to connect said fifth and sixth filter devices, one at a time, in said milking system while disconnecting a respective one of said at least three filter devices by moving said movable filter magazine.

10 6. The arrangement as claimed in any of claims 1-3 wherein said movable filter magazine is provided with a fourth, fifth, and sixth filter device, each of which comprises a tube housing, a disposable filter and a support structure for supporting the disposable filter, and each of which is
15 connectable to said milking system for filtering milk in the milking system, and wherein said actuating device is adapted to connect said fourth, fifth and sixth filter devices, one at a time, in said milking system for filtering milk therein while disconnecting a respective one of said at least three
20 filter devices by moving said movable filter magazine.

7. The arrangement as claimed in any of claims 1-6 wherein said disposable filter is a filter sock.

8. The arrangement as claimed in any of claims 1-7 comprising a sensor for detecting a position of one of said
25 filter devices in said movable filter magazine.

9. The arrangement as claimed in claim 8 wherein said sensor is further adapted for detecting the position of a particularly marked filter device.

10. A method for filtering milk in a milking system, which
30 milking system comprises a milking robot (1); a milk storage tank (3); a milk line (2) connecting said milking robot with

said milk storage tank; and a controller (5) for controlling said milking system, said method being characterized by the steps of:

- providing a movable filter arrangement (4) including a
5 movable filter magazine provided with at least three filter devices (8), each of which comprises a tube housing, a disposable filter and a support structure for supporting the disposable filter, and each of which is connectable, one at a time, to said milk line for filtering milk transported
10 therein;

- moving one of said at least three filter devices into said milk line by means of an actuating device to connect said one of said at least three filter devices to said milk line;

- filtering milk in said milking system by means of said one
15 of said at least three filter devices;

- moving said one of said at least three filter devices from said milk line by means of said actuating device to disconnect said one of said at least three filter devices from said milk line; and

- 20 - moving another filter device of said at least three filter devices into said milk line by means of said actuating device to connect said another filter device to said milk line.

11. The method as claimed in claim 10 wherein said movable
25 filter magazine is provided with a fourth filter device including an empty tube for cleaning said milking system, and wherein said method further comprises the steps of:

- moving anyone of said at least three filter devices from said milk line by means of said actuating device to

disconnect said anyone of said at least three filter devices from said milk line;

- moving said fourth filter device into said milk line by means of said actuating device to connect said fourth filter
5 device to said milk line;

- cleaning the milking system with said fourth filter device connected to said milk line; and

- moving said fourth filter device from said milk line by means of said actuating device to disconnect said fourth
10 filter device from said milk line.

12. The method as claimed in claim 10 wherein said movable filter magazine is provided with a fourth, fifth and sixth filter device.

13. The method as claimed in any of claims 10-12 wherein
15 said method further comprises the steps of:

- detecting a position of a particularly marked filter device by means of a sensor provided in said filter arrangement;

- moving said particularly marked filter device from said
20 position by means of said actuating device; and

- alarming when said particularly marked filter device arrives at said position again.

14. The method as claimed in any of claims 10-13 wherein said steps of moving comprises a revolving motion of said
25 movable filter magazine.

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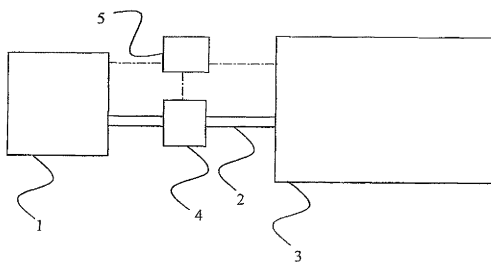


FIG. 1

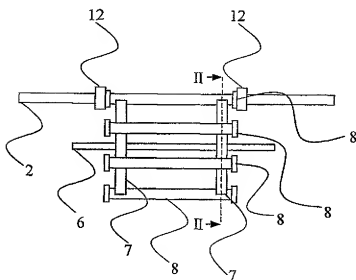


FIG. 2

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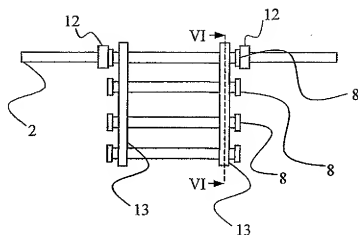


FIG. 5

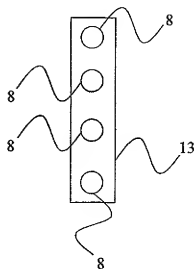


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/00498

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A01J 11/06 // A01J 007/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A01J, B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9828969 A1 (OOSTERLING, PIETER ADRIAAN), 9 July 1998 (09.07.98), figures 5-7, claim 11 --	
A	EP 0653153 A1 (TEXAS INDUSTRIES INC.), 17 May 1995 (17.05.95) --	
A	EP 0951822 A2 (MAASLAND N.V.), 27 October 1999 (27.10.99) --	
E	DE 10046277 A1 (WESTFALIA LANDTECHNIK GMBH), 4 April 2002 (04.04.02) --	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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